

backward in separating supposed species when any appreciable difference could be discovered between two birds.

As, however, I have been able, without looking at the labels, to separate a considerable number of specimens of these representative forms when mixed together, I feel hardly justified in refusing specific rank to *H. guttatus*. I have observed it in Sikim at elevations of from 3000 to 7000 feet in the outer ranges of hills only, and found it paired on the 17th of May, when, from the appearance of the sexual organs, breeding must have commenced. Dr. Jerdon's account of the habits of *H. maculatus* applies equally well to this species.

XXXII.—On the Genus Colius, its Structure and Systematic Place. By Dr. JAMES MURIE, F.L.S. &c.

(Plate X.)

p. 229. 1

By whatever motive we are impelled to study ornithology in its classific aspect, when first the characters of two species are pointed out to us, they appear clear and readily discernible. Proceeding to genera, they too dwell in our mind's eye as axioms, and so on to larger groups.

But soon the time comes when we acknowledge distinctions which are not so obvious. Instead of that sharp definition which we had believed was the attribute of birds in their relations to each other, we are compelled to admit that there is often an interweaving of form, difficult to disentangle and hard to express in words.

The subject of this paper is representative of a group of birds (the Colies) requiring nicety of reasoning to appreciate the value of its characters and their degree of relation ship to those of other forms.

I. POSITION ASSIGNED BY VARIOUS WRITERS TO THE COLIES.

The birds in question are by no means showy, so far as their dress is concerned. The familiar name of "Mousebirds," which the Dutch colonists of the Cape and others have bestowed on

them, is not inapt. It expresses their pervading or dominant colour, and suggests their odd propensity to creep amongst the branches.

A *résumé* of the chief ornithologists who have treated of *Colius* systematically, dates from Brisson*. He it was who stamped the name on the genus, and classed it amongst the Passeres, after the Buntings and Larks (*Emberiza* and *Alauda*), and before the Bullfinches (*Pyrrhula*). Buffon† subsequently placed it between the Bullfinches and the Manakins.

Levaillant's work on African ornithology contains a very elegantly written little chapter respecting the characters and habits of the Colies‡—one worthy of perusal to those who would take a leaf out of nature's book. That eminent naturalist brings them in between the Woodpeckers and Orioles; whilst he asserts that they do not belong to the Bullfinches, as Buffon had marked them.

No hint from the above fellow countryman seems to have been taken by Cuvier§, who, depending on beak-character, retained it in the Sparrow tribe—*Pyrrhula* and *Corythus* ranging on the one side, and *Buphaga* on the other. The traveller Burchell|| suggested its proximity to *Corythaix*. Vieillot¶ about the same time saw likeness in it to the Rollers. Lesson** gives in sequence the Crossbills (*Loxia*), Colies, and Plant-cutters (*Phytotoma*). A slight remove from the last was made by Swainson††, who gave *Phytotoma* precedence to *Colius*—the true Plantain-eaters (subfam. Musophaginæ) coming after, and all three under the family Musophagidæ.

In his 'Genera of Birds'‡‡, the late Mr. G. R. Gray adopted, almost without change, an arrangement like the last, as did Bonaparte in his 'Conspectus.' In the much more recent 'Hand List'§§, Gray's final ornithological labour ere called away from amongst us, the classification runs:—Alaudidæ,

* Ornithologie, tome iii. p. 304.

† Hist. Nat. Des Oiseaux, tome iv. p. 400.

‡ Oiseaux d'Afrique, tome vi. p. 32. § Règne Animal.

|| Travels in South Africa, vol. i. p. 214 (footnote).

¶ Encycl. Méth. p. 864.

** Manuel, tome i. p. 334.

†† Nat. Hist. and Classif. of Birds, vol. ii. p. 296.

‡‡ Vol. ii. p. 392.

§§ Vol. ii. 1870, p. 123.

Colidæ, Musophagidæ, Opisthocomidæ, and Bucerotidæ. Rüppell's 'Monograph'* deals more with the specific forms of *Colius*, and no fresh discussion of its affinities is entered into. Hartlaub† retains it among the Musophagidæ, and near the Pyrrhulinæ.

Most of the foregoing writers either have taken for granted that the Passerine characters were genuine, and its affinities tolerably clear, from general outward appearance, or on the same principle saw fit association with the Plantain-eaters. Nitzsch‡, in assigning it likeness to the latter and to the curious *Opisthocomus*, broke new ground in his reasons, besides seeing likeness to the Hornbills and others; whilst Wallace§, from an entirely different point of view, deduced association of a novel kind; which has been uttered with so much perspicuity that I may be pardoned for here quoting his words in full.

"We have now only one more group to introduce into our Scansores; but it is one of extreme interest, as tending in some degree to fill up the wide chasm which separates the Psittacidæ from all other birds. This we believe is done by the Coliidæ, a small group of birds peculiar to Africa, and which have been generally classed as Finches, from their small size and thick beak. The particulars which Le Vaillant gives of their habits are, however, exceedingly curious, and show a resemblance to the Parrots which no other birds exhibit. They live entirely on fruits, never touching either seeds or insects; they never perch or jump; they walk with the whole tarsus applied to the ground, creeping, as it were, upon their belly; they are very fleshy, and weigh twice as much as another bird of apparently the same size; for their feathers are so short and so closely laid upon their body that they are really much larger than they appear. They have also very weak wings, and can fly a very short distance. They climb up to the top of a tree or bush to fly to another, and in doing so lose elevation so as generally to arrive at the foot of it. They climb one foot after the other, and help themselves on with their beaks.

* "Monog. der Gattung *Cygnus*, *Ceblepyris*, und *Colius*," Mus. Senckenb. p. 41.

† Syst. der Ornith. Westafrika's, p. 155.

‡ Pterylographie.

§ Ann. and Nat. Hist., Sept. 1856, p. 213.

"Now, almost the whole of this description will apply to some of the Parrot tribe and to no other birds. Their bill is an approach to that of the Parrot, the upper mandible being thick, much curved, and acutely pointed, while the lower is much smaller, and nearly straight. Their feet are very peculiar, the hind toe being small and capable of being turned forward. The tongue is described as cartilaginous and flat—one step from the ordinary horny-tipped tongue to the fleshy one of the Psittacidæ. We consider therefore the Coliidæ to be more nearly allied to the Parrots than any other birds, and to be an isolated link serving to connect them with the other Scansores in the direction of the Musophagidæ."

On very different grounds, M. Emile Blanchard*, a good authority respecting the osteology of birds, offers the following opinion:—"Un petit groupe d'oiseaux d'Afrique, les Colious (*Colius*, Briss., *Coliidæ*, Bp.) ont été généralement classés parmi les Passereaux. Au contraire, plusieurs zoologistes, d'après la considération de leur plumage, ont cru devoir les rapprocher des Musophages. Or je ne connais pas le sternum des Colious, ce qui est vraiment fâcheux ; mais M. Ed. Verreaux m'ayant obligeamment donné un individu *en peau* de l'une des espèces de ce genre, j'ai pu étudier les caractères des membres et de la tête. Cette étude, on le verra par la suite, me conduira à établir que les Colious sont étroitement liés aux Rolliers."

Prof. Huxley†, without assigning any explicit reason further than "The first toe turned forwards, as well as the others," locates the Coliidæ as a separate family of his Coccozomorphæ.

I might quote Layard‡, Blanford§, and Dr. Otto Finsch|| as among recent writers who have had something to say regarding the Colies ; but they all associate them either alongside or under the family Musophagidæ¶. As to the Colies' habits they mainly substantiate the earlier authorities. Layard, however, mentions

* Ann. des Sciences Nat. tome xi. p. 138.

† "On the Classification of Birds," P. Z. S. 1867, p. 466.

‡ Birds of South Africa, p. 221.

§ Observations on the Geology and Zoology of Abyssinia, pp. 56, 317.

|| Trans. Zool. Soc. vol. vii. p. 276.

¶ I regret omitting Schlegel's paper on *Colius*, Amsterdam, 1857, and Eyton's notice, neither of which I could conveniently lay hands on.

that, according to the natives, several birds lay their eggs in one nest—a remarkable circumstance, if true. Mr. William Jesse, who accompanied the Abyssinian expedition, and whose specimens have been described by Dr. Otto Finsch, notes (*l. c.*) that the contents of the stomach are chiefly fruit and berries, but in one specimen mimosa-seeds were found. The latter fact is at variance with Levaillant's observations.

II. PTERYLOSIS AND POINTS OF INTERIOR ORGANIZATION.

Nitzsch*, above all others a most skilled observer of plumage, says that *Colius* "has a remarkable arrangement of the feathers, and can only be compared in this respect with *Buceros*."

He ranges it under his group of Amphibolæ, in which *Corythaix* and *Musophaga* precede and *Opisthocomus* follow. From the first two of these it is distinguished by the stems of the inferior tract being dilated, and no diverging outer branch; from the third by its dorsal tract being dilated on all sides and sparsely feathered.

The rectrices are 10, the two outermost exceedingly small; remiges 19, ten inserted on the pinion, 5th longest, the first four graduated.

According to Johannes Müller†, *Colius* has a simple thick vocal muscle; *Corythaix* has no muscle to the inferior larynx. Owen's notes on the Purple-crested Touraco (*C. porphyreolopha*, Vig.)‡ and my own observations coincide.

The tongue is said to be flat and cartilaginous, with horny papillæ§, therefore differing alike from the Musophagidæ and the Finches.

Of the stomach, Rüppell says, it is of a semimuscular kind. Whether cæca are present or absent in the intestines has not been recorded, so far as my search amongst the literature extends.

III. DESCRIPTION OF THE SKELETON OF *C. leucotis*, Rüpp.

1. *Bones of the Chest*.—In proportion to the size of the bird,

* Pterylographie, Engl. Trans. Ray Soc. 1867, p. 107.

† Bericht d. Akad. d. Wiss. zu Berlin, 1841, p. 179. Müller's Archiv, 1842, p. 11; and Abhand. d. Königl. Akad. Berlin, 1845-47, p. 330 &c., pl. v. figs. 9 to 12.

‡ P. Z. S. 1834, p. 4.

§ Rüppell, Monog. already quoted, p. 41.

the breast-bone or sternum is long and remarkably shallow. Indeed this want of depth is a striking feature, especially as regards the pectoral plates: these are flattish and chevron-shaped; their united cross diameter is barely more than half their length. In one specimen (Pl. X. fig. 13) I found the outer edges of the breast-plate possessed three denticulations, giving a serrate appearance to each margin; but in another, obtained from the same locality, the borders were only slightly sinuous and free from notching.

On each side are two long delicate bony rods, the "xiphoid processes," an "external" and an "internal," the tip of the breast-plate being named the "middle" one. The latter is a trifle the shortest, the former two pairs terminally pedate. The external xiphoid process runs on almost to the rib-facets; the internal process is shorter. The keel shallows gradually backwards with a very gentle curvature. Its anterior upright margin is larger, below moderately produced, and above running into the prominent sharp rostrum. This latter is indented, but barely cleft, at the tip, and has a small fossa internally at its base, which connects the shallow grooves lodging the coracoids. The elongate triangular costal process, partially overlapped by the coracoid, has four facets for as many ribs.

The furcula (clavicle) at the sternal end possesses an intermediate inflected process, the interclavicle or "hypocleidium." The lower half of each furcular limb is flattened from above downwards; the upper half, on the contrary, is laterally compressed, and widens out at its scapular junction into what goes by the name of "præcoracoid."

The bladebone (scapula) is narrow, thin, and ensiform, with a very slight terminal curvature.

The shaft of the coracoid is on the whole rounded. Its sternal end, the "epicoracoid" of writers, may be compared to the blade of an oar. Superiorly the bone is united to the scapula with moderate enlargement; and there is a short depending process of bone, the "mesocoracoid" of Parker. Each coracoid is a trifle shorter than the sternal plate.

There are eight ribs on either side of the thorax. The first and second are short, and do not reach the sternum. The third

to the sixth are sternally attached. Recurrent processes obtain from the second costa to the sixth.

2. *Vertebræ and Rump-bones*.—The neck-vertebræ are eleven or twelve, according as we accept the last one (with a very short riblet) as belonging to this series or not. In the back or dorsal region (that is, as far as the pelvic bones) there are eight vertebræ. The spinal portion of the pelvis appears to be composed of ten or eleven closely united vertebral elements. These segments are indistinct, and appreciable only by the markings of transverse processes, visible from above. Of free tail-vertebræ seven obtain. The final one of all, or, as it has been termed, "pygostyle," possibly consists of a couple or more pieces, but so consolidated together that they may, for all practical purposes, be recognized as but one.

Put in formula, therefore, the numbers would run :—

11 or 12 Ce ; 8 D ; 10 or 11 Ls ; 7 Cd = 36 or 38.

The rump-bone, or pelvis*, has been taken into consideration but by few ornithologists; and yet it is not devoid of characters.

The iliac bones chiefly occupy the dorsal region. The rear halves of these in *Colius* are together wide and quadriform, with a smooth moderately convex surface. The fore halves narrow considerably, are concave, and set obliquely towards the spine. The latter is defined from the ilia quite in front; but coalesces with them posteriorly. A line drawn through the foramina of the hip-joints (acetabula) gives an area in front, "præacetabular," that behind being termed the "postacetabular." In *Colius*, the former is narrower than it is long; the reverse obtains in the latter. The interior, or renal surface is flat, shallow, and corresponds in outline to that described above.

The ischium forms a lateral flank, posterior to the acetabulum; and, whilst long and produced into a tapering process behind the "tuberosity," is nowhere very deep. Below it is the "pubis,"

* Eyton ('Osteologia Avium') duly notes its importance. Huxley, "On the Classification and Distribution of the Alectoromorphæ and Heteromorphæ," P. Z. S. 1868, p. 298, seizes its taxonomic points. Alph. Milne-Edwards appreciates diversity of conformation in his great work 'Oiseaux Fossiles.'

a delicate lengthened osseous rod. Above each acetabulum is a small eminence and facet, from which a line drawn backwards marks the junction of the ilium and ischium—this being sharp but not specially overarching. The ischial foramen beneath is of a long oval figure.

3. *Wing- and Leg-pieces*.—Of the wing-bones, the humerus is short and relatively stout, both in the head, which is capacious, and in the rounded shaft. The pneumatic foramen, as usual, opens under the head. A small tubercle juts out above the outer lower condyle.

The bones of the forearm barely exceed the humerus in length. The radius, more usually slender, in this case has proportionally a stout shaft compared with the ulna. Metacarpals and phalanges are each and all of goodly thickness; and the first metacarpal is broad. A delicate plate, or partial bridge of bone, passing from the first to the second metacarpal at their upper (proximal) ends is noteworthy.

The femur is by no means so powerful as the humerus, their length being almost identical. Its trochanter is rather rounded, and not prominently ridged.

The tibia, again, far exceeds the ulna in magnitude; and the fibula is diminutive and spicular. The upper anterior tibial tuberosity (or “cnemial” ridge) is not prominent as in some birds. Inferiorly, there is a small intercondylar bridge of bone, through which the extensor tendons pass at the joint; but some of these are also restrained by ligamentous bands situated obliquely. A tiny tubercle of bone above the external condyle marks the outer attachment of the latter.

The tarsus, or, as more frequently named by anatomists, tarso-metatars, is about two thirds the length of the tibia, and has a more antero-posteriorly compressed shaft. In front a longitudinal, but somewhat oblique convex ridge traverses from the upper outer margin to the lower middle and partially inner digital knuckle. Behind, the fluting of the shaft is straighter and to the inner side. The proximal or articular end of the bone, which plays against the bottom of the tibia, is concavely incised at the middle of its fore border. At its hind border is the so-called “calcaneal” eminence—in this case small, semi-

lunar, and pierced towards its inner side by a foramen. The distal or inferior articular end of the tarso-metatarsus is relatively wide, and provided with three grooved knuckles (condyla), of nearly equal length, for as many of the outer toes.

That which is named the metatarsus is a diminutive canary-seed-shaped ossicle, which lies a trifle behind the inner lowermost end of the shaft of the tarsus. It is so placed that the axis of the first or inner toe (hallux) is directed partially forwards and inwards.

Although all the four toes of *Colius* are affirmed to be directed forwards, I find that the inner (hallux) is perfectly capable of being thrust nearly backwards. This may not be its natural condition; the joint, however, displays ready movement in a semicircle. I think it can hardly be doubted that for those habits which the Colies possess in perfection (clambering along branches and stems, traversing sideways, and suspension) it will be admitted that a certain amount of opposition of the digits is necessary. Unlike the Perchers, which require grasping-power attained by complete reversion of the first toe, and the true Scansores, with the fourth toe also turned behind so as to seize the slightest inequality, the Colies have the inner toe capable of wide abduction. It may therefore be compared to a human hand strongly clawed, which, by a kind of griping or squeezing of the digits, securely fastens to the slightest inequalities of surface.

The inner toe is shortest, the third longest, and the second and fourth subequal. All are armed with strong, laterally compressed, curved claws, which are inferiorly grooved. The usual avine number of the phalanges obtains, viz. 2, 3, 4, 5 respectively, in the digits, counting from within outwards.

The segments of bones comprising the wing and leg of birds bear a certain ratio of length the one to the other. When closely investigated, it appears they often tally with the avine grouping drawn from other characters. I shall, in this place, only record the absolute length, in inches and decimals, of one species of the Colies examined by me. I give elsewhere* the proportions and comparisons in full, so need not trouble the

* "Anatomy of the Alcedinidæ" (Kingfishers), now in the press.

reader beyond an after statement of probable alliances drawn therefrom.

C. leucotis, Rüpp.

	Humerus.	Ulna.	Meta- carpus.	Mid pha- langes.	Total length.
	in.	in.	in.	in.	in.
Wing	0·95	0·9	0·55	0·45	2·85
	Femur.	Tibia.	Tarso- metatars.	Mid-toe phalanges.	Total length.
Leg	0·9	1·35	0·95	0·8	4·0

4. *Skull and Mandible*.—Both the tip of the latter and the whole of the beak are ensheathed with what, in the dried specimen, is a very hard, terminally thick, horny case. In the beak it projects with a slight hook, less or more marked according to the species. In the lower jaw, as in Parrots, besides clothing the bony contour, it pouts at the symphysis in a deflected narrow gutter, which, however, is overlapped by the upper mandible.

The bones of the lower mandible are not very strong, being thin and laterally compressed, but of some depth. Each half or ramus has a low antero-posterior arch, the bend being most perceptible at the narrowed apex. There is an elongate fissure or imperfect ossific space about the middle of the bone, at what is termed the “dentary” division by embryologists. At the joint or articular end the bone is moderately developed. The cavity wherein fits the “quadrate” is deepish. There is a well-marked internal angular process. Postarticular process is well-nigh obsolete; but there is a pronounced angle quite at the inferior extremity of the jaw.

The skull does present certain points in common with some of the *Musophagidæ*; but it is also undeniable that it closely resembles some of the *Finches*’, not alone in size but in each exterior aspect!

The hinder segment, or that containing the brain, is broad, full, and rounded, and of considerable depth. At the same time the top of the skull is not so very high, the ascent from the beak having a gradual slope.

Superiorly the frontal space between the orbits is of medium width, and rather short on account of the postfrontals coming well forwards. It is deeply hollowed. The prefrontal processes

do not protrude much; and the postfrontal processes are likewise short, as are the zygomatic. The septum orbitale has a considerable open space below; and each orbital plate is partially membranous.

As regards the bones which surround the occipital foramen, and that in front, which has been named "basitemporal" by Parker*, I need only say they are plump.

The articular or quadrate bone has a short orbital process. Its inferior or distal end is unlike the Parrots', and similar to some of the *Raptores*' in the internal and external knuckles being subequal in depth, the former compressed and set obliquely inwards, whilst the posterior knuckle is short and flat. The pterygoid bars are of medium stoutness and length, and directed well inwards. Jugal rods slender.

The most important features of the base of the skull have yet to be mentioned, namely the palatal construction. I regret to say, however, that slight injury to the parts makes me speak with a degree of caution; but I believe, and as far as I could make out, they are as I shall describe. Quite in front the inferior surface of the præmaxillæ forms a short, somewhat triangular or arrow-headed concave area. Widely apart from this start rearwards the palate-bones. The fore half of each of these, as in the Finches and some of the *Raptores*, is narrow, rod-like, and convex superficially, and nearly horizontal, or with a trifling outward tilt. The hind half widens out into a great thin plate of bone, truncate posteriorly, and with a decided inward obliquity. The inner margin possesses a longitudinal groove, and meets its fellow of the opposite side, they together lying on the long central beam inferiorly dividing the orbital cavities and termed the "rostrum of the basisphenoid."

The maxillaries do not appear to obtrude much into the basal aspect of the beak, at best only to be detected on the outside of the præpalatals. The inward processes from these, called "maxillo-palatines" by Huxley† (which in many birds contribute

* Fully traced in its development in many birds; see his numerous important memoirs to the Royal, the Zoological, and the Ray Societies.

† *Vide* P. Z. S. 1867, p. 419 (footnote). Nitzsch, fully half a century ago, called attention to the *Knochenkapsel* or *Muschelbein* as analogous

much to form the roof of the mouth), are in *Colius* relatively small. They may be spongy or slightly lamellar; but this I cannot aver with certainty from the condition of the specimen; at all events they intrude but a slight way beyond the palatal rods, and leave a wide middle space betwixt them. As respects the presence of a vomer, there is apparently a short one, tapering rather than abruptly truncate anteriorly, and not visibly deeply cleft behind.

Lastly, the hinged beak is perforated by large and wide nasal apertures, which extend well forwards; the lachrymal or tear-bone is nearly perpendicular, its inferior limb spongy; and there is no depending spicule or crotchet bone*, nor any backward upper orbital process.

IV. STRUCTURAL COMPARISONS AND AFFINITIES.

From the great majority of the Passeres (Coracomorphæ of Huxley) *Colius* is trenchantly separated by its possessing two pairs of notches on the sides of the sternum. Neither is its sternal manubrium deeply forked, nor do the pectoral plates correspond in figure &c. to them. Even in *Scytalopus* and *Pteroptochus*, aberrant Passerine genera, with four clefts and xiphoid processes, these and the pectoral surfaces are very different from the *Coly* type; besides other details, their rostrum is deeply cleft. *Phytotoma*, though classed by some among the Musophagidæ, Blanchard† says has the sternum like those of the Finches.

The wing-bones of *Colius* are relatively shorter and stouter than those of the Finches, Larks, and Orioles it has been associated with. In these latter and the Sparrow-tribe generally, six canals for the flexor tendons perforate the tarso-metatarsæ; their first toe is strong and turns backwards. The *Coly* therein differs.

By the non-truncation forwards and want of cleavage behind in the vomer, by the difference in the maxillo-palatines (if I inter-

to the "antrum Higmori" of the human cheek-bones (Osteographische Beiträge zur Naturgeschichte der Vögel, p. 26).

* See paper by Prof. Reinhardt "Om en hidtil ukjendt knogle i Hovedskallen hos Turakoerne (Musophagides, Sundev.)," Copenhagen, 1871.

† *L. c.* p. 90.

pret these correctly), by the brevity of the orbital limb of the quadrate, and relative diminution of the articular knuckles, it cannot be classed with them. If these reasons apply to one division of the Passeres, it equally holds good with *Phytotoma* and the Orioles.

The Passerine tongue, vocal apparatus, and feathering are sensibly modified in *Colius*.

From the Psittacidæ our genus is as much distinguished—the Parrots having two sternal foramina instead of clefts, and clavicles either absent or disunited and always without hypocleidium. They again excel in the proportion of all the segments of the bones of the wing, but possess a humerus diminished in comparison with the wing's length. In contrast, the *Coly* far exceeds the Parrots in the proportion of each leg-bone to the femur, but shows inferiority when the entire length of the leg is the standard, save its long tarso-metatarsæ. In Parrots the outer lower articulation of the latter has two facets, and the fourth toe is permanently turned backwards. The Psittacine inferior mandible differs in several respects. Their lachrymal bone has a long inferior backward limb; they have a single laterally compressed inferior articulo-quadrate facet; their pterygoids are more elongate, their maxillo-palatines more extensive; præmaxillæ greatly curved over lower mandible, and other specialities (pterylosis and inferior laryngeal muscles),—all in contrast to *Colius*.

As to the Musophagidæ (supposed allies of our form in question), their characters break down when compared with *Colius* in detail. Although their sterna have two pairs of notches and processes, yet each of these is relatively short, the latter thick, not pedate, and the middle xiphoid terminally wide and abruptly truncate: the breast-plates are quadriform and deeper; rostrum abbreviate; five, not four, costal facets; furcula narrow above, and without hypocleidium; a supracoracoid foramen, not a simple groove; coracoids relatively shorter and stouter; epicoracoids unusually wide, and, in some cases, overlapping; scapula nearly straight.

One less caudal vertebræ, and the coalesced lumbo-sacrals apparently in excess of *Colius*. The latter has advantage in metacarpo-phalangeal length; an external inferior condylloid tubercle, and an osseous bridge betwixt the metacarpals; in other respects the wing-elements correspond. In leg-proportion of the *Coly* to the *Touraco* it resembles the Parrots (as above stated), the metatarsus being greatly in excess. Femoral trochanter and cnemial ridge of tibia large and prominent. The other grooves and articular surfaces agree; but the set and anterior position of the toes are most unlike—the *Musophagidæ* having fourth and first backwards; in *Colius* they are all forwards.

The pelvis of the *Turacoes* has the fronts of the ilia united into an arch, and the lumbo-dorsal muscles and tendons pass beneath; the iliac blades expand forwards (as in the Cuckoos); and the proportion of the præacetabular area is longer, the post-acetabular area is narrower in proportion to length; the ilio-ischiac junction forms a prominent shelf; and there is great depth of the ischium itself. In all these particulars, therefore, the pelvis is dissimilar to that of the *Coly*.

An outward resemblance in the skull of the two groups of birds compared is not substantiated by the basal plan of the maxillo-palatal segment and other particulars. Nearly, if not all, of the *Plantain-eaters* have a development, and sometimes a curious one, of the crotchet bone (infralachrymal). This is absent in the *Colies*. The *Musophagine* spongy maxillo-palatines meet in the middle line; their palatal plates are less wide apart, broader fore than aft, and throughout horizontal; cut sharper off posteriorly, and inwardly have not the characteristic valley of *Colius*. Their præmaxillæ possess a high culmen, in some of the genera forming quite a nodosity; nasal orifice small, round, and placed well forwards; beak terminating in a long deflected point, that of *Colius* being shorter, and the nares very large.

Both the tongue and the vocal apparatus of the *Touracoes* disagree with those of the *Coly*; and so even do the plumage and coloration to a degree.

The *Rollers* (*Coracias*), as Vieillot and Blanchard both sur-

mise, exhibit a relationship to our form, but, like the last-mentioned, very considerably modified. Their sterna have quadruple notching; but the shortness and strength of the xiphoids, depth of pectoral plates, occasional want of interclavicle, supracoracoid foramen, &c. define them most trenchantly from *Colius*. Their pelvis, however, has a form approaching nearer to the latter than that of the Musophagidæ. On the other hand, a longer-beaked skull, the cranial vertex high, and præmaxillæ give a totally different contour. There are rudiments of basipterygoids in *Coracias**; the zygomatic spicule reaches the jugal; præmaxillary hinge almost deficient; interorbital septum totally ossified; maxillo-palatine construction more like *Turacus* than *Colius*; mandibular and other points are all significant of separation of cranial character.

The whole of the leg-bones of the Roller are shorter throughout, and especially that important one the tarso-metatarsus. This fact even comes out stronger when the homologous pieces of the leg and wing of the genera compared are studied; for *Coracias*, be it observed, has a long ulna.

There are some points in one genus of the Rollers which point to alliance, even if otherwise subdued: I allude to *Colaris*. In this form there is a progressive shortening of the beak, a wider separation of the maxillo-palatines and palatal plates, and, anteriorly, presence of hypocleidium and a short thickish tongue.

One short notch on each side of a massive sternum, a great prow formed from keel, bifid manubrium, absence of interclavicle, &c. distinguish the Bucerotidæ. These have one dorsal vertebra less. Their pelvis is vastly different in shape, proportional length to breadth of præ- and post-acetabular areas, ischial shortening, flattening, and an additional external marginal process evince complete separation. Their skull is quite as singular; and in limb-bones more especially, the shortening of tarso-metatarsus, position of toes, and syndactylism offer the reverse of coincidence to the *Coly* tribe.

* Huxley states there are none, "Classification of Birds," P. Z. S. 1867, p. 448.

The equally remarkable *Opisthocomus*, although placed in close apposition to *Colius* by Nitzsch on pterylographic grounds, presents remoteness from this form osteologically. The very numerous points of difference I need not dwell upon, but instead refer the reader to Huxley's* terse and graphic description. Even a comparison of the present plate with his woodcuts will suffice.

As regards the fictitious brotherhood of the Colies with the Woodpeckers, possibly from their branch-creeping propensities—their organization is of a most opposite kind. Neither the shape of the skull, its constituent upbuilding, the sternal and shoulder-girdle configuration, the number of the terminal spinal vertebræ, the shape of the pelvis, disposition and length of toes, tarsal proportion, tongue and visceral structure, nor the pterylaxis displays conformation which would suggest their being ranked together.

I might extend my comparisons ; but I fear I have already drawn them out to an inordinate length. I presume, however, that my evidence will be sufficient to show that *Colius* consistently is not a true Passerine (or Coracomorph)—a verdict already arrived at by ornithologists studying external characters alone. No more do I find from my observations that it is either a true Parrot (Psittacomorph) or an aberrant one, as the shrewd reasoning of Wallace from habits &c. would imply. As little does its organization comport with the Woodpeckers' (*Celeomorphæ*), the Hornbills', or that of the Hoazin (*Opisthocomus*, a Heteromorph). To the Rollers and the Touracoes (Coccygomorphs) undoubtedly there are many structural traits which suggest affinity. But so, on the other hand, might we as well assume it to be a Finch, from the remarkable similarity of the one skull to the other.

The facts are these : if we take one set of regional characters—the feet, the head, the breast-bones, the pelvis, and so on—we can place it in as many different groups ; we can even trace Raptorial kin ; so that it is hard to say where *Colius* could not be

* Chapter III. "On the Affinities of *Opisthocomus*," in his paper in P. Z. S. 1868, p. 304.

wedged in, and plausibly too. Not only is it entitled to be considered aberrant, but to afford the strongest proof of the inter-linking of type—not in the chain-series so often advocated, but, like the Isle of Man tripodal coat-of-arms, kicking its legs about, and whichever alighting upon, there it stands.

But if, in the true spirit of ornithology, we take the bird in its completeness, it will be allowed it does not so closely resemble any acknowledged individual group as to come under its definition.

Without advocating its proper place, I propose equally to exclude it from the old Fissirostral and Scansorial, and the Passerine groups, the recent Coccygomorphæ and Coracomorphæ. It, as I conceive, is equally with the Woodpeckers and Goatsuckers, Celeomorphæ and Cypselomorphæ, annectent betwixt the Coccygomorphæ and Coracomorphæ.

Professor Huxley, in his severely heterodox arrangement (*l. c.*), gave a brief diagnosis of his Coccygomorphæ. With several of its essentials the *Coly* does not agree, no skeleton having probably been seen by the above writer. With prescience he hints the said groups may hereafter be required to be divided; and in this I acquiesce, the Coliidæ here being the first slice I have removed, the Todiidæ* partly taking its place.

Before adding characteristics of the Coliomorphæ I may curtly allude to genera of the Colies. Apart from synonyms, *Colius*, Briss., *Urocolius*, Bp., *Rhabdocolius*, Bp., and *Hypocolius*, Bp., are admitted by some. Skins and stuffed specimens of the first three of these I have carefully examined. To ornithologists these genera may be good; but I think, if bird-genera are so feebly defined, Heaven help the coming generation of workers!

CHARACTERS OF THE COLIOMORPHÆ.

In these the rostrum is arched, slightly bent at the tip, and with a frontal movable hinge. Nares large; external aperture basal, naked, linear, and oblique. Maxillo-palatines diminutive, wide apart. Palatines are narrow, rod-like in front, and posteriorly expand into large, partially horizontal, truncate plates. Only

* Paper lately read by me before the Zoological Society, May 1872.

slight ossification of the nasal septum, with extensive naso-palatine space. Vomer short, acuminate anteriorly, and without cleft posteriorly. No basipterygoid processes. Absence of crochet or infralachrymal bone. Quadrate with a short orbital process; articular knuckles subequal in depth, the inner one laterally compressed and obliquely set. Mandibular rami delicate, deep; a large dentary space; internal angular process well developed; a pronounced postinferior angle. Sternum 4-notched; xiphoids very long and slender. Keel and pectoral plates shallow, the latter occasionally denticulate. Four rib-facets. Rostrum indented, but not deeply cleft. A large interclavicle present; and præcoracoid moderately wide. Pelvic postacetabular area wide and square; præacetabular without special median contraction; the iliac margins do not form spinal bridges. Ilio-ischial junction without special outward shelving; ischial tuberosity lengthened. Tarso-metatars long, the calcaneal process pierced by one foramen. All four toes turned forwards, and furnished with acute slender claws. Tongue flat, cartilaginous, with horny papillæ. A simple inferior laryngeal muscle. Stems of the inferior feather tract sparse, dilated on all sides, and no diverging outer branch.

DESCRIPTION OF PLATE X.

The skeleton, minus the ribs and some of the vertebræ, of the Bejook *Colius* (*Rhabdocolius*, Bp.) *leucotis*, Rüpp. The bones are drawn as nearly as possible of their natural dimensions, excepting figs. 7, 8, 26, and 27, which are enlarged to double their size.

Fig. 1. Upper cranial surface.

Fig. 2. The lower surface of the skull.

Fig. 3. Profile of the cranium.

Fig. 4. The lower jaw or mandible in side view.

Fig. 5. Upper or oral surface of the same.

Fig. 6. Occipital surface of skull without the mandible.

Fig. 7. The quadrate or articular bone on its outside and anterior aspect.

Fig. 8. The same bone of the right side, from below. Each twice nat. size.

The following lettering applies throughout to the corresponding parts of the skull in the above figures:—

pmx, præmaxilla; *n*, nasal; *l*, lachrymal; *p*, palatine; *mep*, maxillo-palatine; *vo*, vomer?; *po*, postfrontal process; *z*, zygomatic process; *pt*, pterygoid; *ju*, jugal; *q*, quadrate; *fm*, foramen magnum; *ia*, internal

angle; *a*, angle of mandible; *ds*, dentary space; *ol*, orbital limb; and *ik*, internal knuckle of the quadrate.

Fig. 9. The rump-bones and tail, or pelvis and caudal vertebræ, shown laterally.

Fig. 10. Interior view of the same parts.

Fig. 11. Upper or dorsal surface of the same.

Points in the anatomy of the pelvis &c. are specified as subjoined:—

il, *il**, ilium, its anterior and posterior divisions; *is*, ischium; *t*, tuberosity; *sp*, spine of same; *p*, os pubis; *a*, acetabulum; *f*, facet; *o*, obturator notch or foramen; *if*, ischiatic or thyroid foramen; *sa*, coalesced sacral vertebræ; *cd*, caudal vertebræ; *py*, pygostyle; dotted line indicates its natural position.

Fig. 12. A side view of the sternum and shoulder-girdle.

Fig. 13. The inferior pectoral surface of the same.

The parts lettered in these two figures are:—

k, keel; *r*, rostrum; *mx*, middle xiphoid; *ix*, internal, and *ex*, external xiphoid process, the spaces corresponding; *cp*, costal process; *co*, coracoid; *ep*, epicoracoid; *f*, furcula; *hy*, hypocleidium; *sc*, scapula; *g*, glenoidium or articular facet.

Fig. 14. Left upper wing-bone or humerus, seen from behind.

Fig. 15. Its superior end (shoulder-joint).

Fig. 16. Its lower end (elbow-joint).

Fig. 17. The remainder of the wing-bones.

Fig. 18. Upper radio-ulnar articulation.

Letters have the undermentioned signification:—

h, head of humerus; *pn*, pneumatic foramen; *u*, ulna; *r*, radius; *c*¹ and *c*², first and second carpal bones; *m*¹ and *m*², first and second metacarpals; *d*¹, *d*², and *d*³, digits, first, second, and third, respectively.

Fig. 19. Thigh-bone of the right side, front view.

Fig. 20. The left tibia in profile, outside view.

Fig. 21. Tibia and fibula, anterior aspect.

Fig. 22. Posterior aspect of the same.

Fig. 23. Posterior surface of the left tarso-metatars.

Fig. 24. Profile of the same, seen from without.

Fig. 25. The left tarsus and foot, seen from behind.

Fig. 26. Upper articular surface of the tarso-metatars.

Fig. 27. Lower articular end of the same. This and preceding enlarged to about double their natural dimensions.

The lettering runs:—

t, tibia; *f*, fibula; *e*, bony eminence or tuberosity; *tm*, tarso-metatars; *m*, metatarsal piece; I, II, III, IV, digits; *ca*, calcaneal tuberosity or "hypotarsus."

